# A Consolidated Observations and Review over UWSN's Routing Protocols

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*Abstract*— The water is vast as it covers around 140 million square miles; more than 70% of the Earth's surface, and half of the world's population is found within the 100 KM of the sea areas. In many fields like adventurous purposes, existence of natural resources, transportation and defense UWSN playing vital role. With the growing role of sea in human life, determining these largely unexplored areas has gained more importance during the last decades. Recently, many researchers in these days choosing Underwater Wireless Sensor Networks (UWSNs), because old methods for underwater monitoring missions have some weaknesses like they are using un-manned survey, high water pressure, unequal underwater events. UWSNs is quickly increasing interests of researchers as it collects and monitor data for groups of underwater robots, pollution monitoring applications, equipment control and equipment monitoring. The main aim is to enhance various issues and create a new set of routing protocols inside important changes in the underwater wireless sensor network and terrestrial network. In UWSN underwater sensor nodes run on the batteries, so, if once node is installed, it's very difficult exchange or charge. By this efficiency of energy plays main role in UWSN. Initially we consolidated routing protocols into categories. After this we discussed future research issues of routing protocols are sensibly examined and also perform comparison of routing protocols.

***Key words:*** Underwater Wireless Sensor Networks (UWSNs), Routing Protocols

## I. Introduction

Over the previous few years, there has been a rapidly growing amount of research on UWSNs owing to their wide applications in many underwater scenarios, e.g. marine atmosphere perception, contamination following, helped route, strategic submerged reconnaissance, catastrophe avoidance, etc. Almost all the applications need underwater sensor nodes to effectively provide correct identified data. Be that as it may, because of the complex submerged condition, how to rapidly and viably transmit the gathered information to the sink hub on the sea surface is an exceptionally difficult research issue. All things considered, there are numerous directing conventions that have been proposed for earthly remote sensor systems (TWSNs). Be that as it may, these are not appropriate for UWSNs, for the most part as a result of particular attributes of UWSNs, for example, dynamic structure, limit data transfer capacity, quick vitality utilization, and high transmission inactivity. In this way, various novel directing traditions have been especially proposed for UWSNs.

Because of the complex underwater environment, however, it is a very difficult research problem the way the collected data can be transmitted quickly and effectively to the nodes sinking on the surface of the sea. Indeed, there are many routing protocols proposed for terrestrial wireless sensor networks (TWSN). However, these are not suitable for UWSNs, mainly because of the specific properties of UWSNs, such as dynamic structure, reduced bandwidth, fast power consumption and high transmission latency. In this manner, numerous new steering conventions have been proposed particularly for UWSN. In this article, we examine some of these routing protocols and provide a comparison table of the most important. Ordinarily, sensor hubs in UWSNs are versatile and drift openly with sea current flow. Therefore, the established routes must be regularly updated and maintained, which obviously involves high energy consumption. However, it is realized that all sensor hubs are vitality constrained and hence it is hard to execute vitality effective directing conventions for UWSNs. In directing conventions for UWSN, the way choice can be separated into two classes: sender and beneficiary. In sender-based steering conventions, the sending hub chooses its own next bounce hub while in the collector based directing conventions the following jump hub is chosen from the neighboring hubs of the sender.

In comparison, receiver-based routing protocols are much more energy-efficient than transmitter-based protocols, since communication costs are reduced. That's why this article discusses routing protocols based on two sender and recipient-based categories. Finally, questions and conclusions are opened in the coming section

The current research in UWSNs aims to meet the above criterion by introducing new design concepts, developing or improving existing protocols and building new applications. While considering submerged sensor systems, due thought must be given to the conceivable difficulties that might be experienced in the subsurface condition.

## II. Environment of Signals for UWSN [22]

Underwater communication has four major basic environments as shown in figure 1 are followings:

### A. Acoustic Waves:

Acoustic signals that can travel to longer spaces. When temperature increases by 1°C, sound speed increase by 1.4m/s. As the depth of the water increases by 1km, sound speed increases by 17m/s, but it has narrow bandwidth. The apparatus used to convey figures within these environments is the general hydrophone. Due to the drawbacks of many other signals, it is observed that acoustic waves usually carry information inside the water with more accuracy.

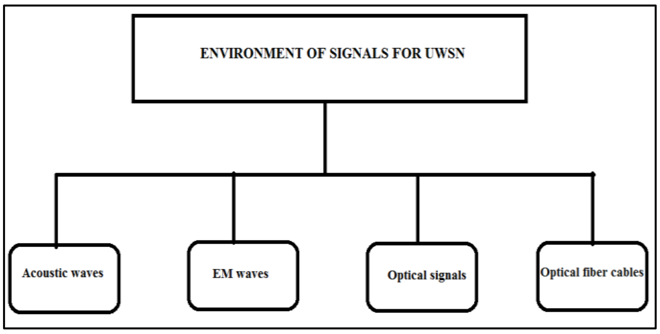


Fig. 1: Environment of signals for UWSN

### B. EM Waves:

Electromagnetic waves operate in a limited power region and are rapidly reduced to water.

### C. Optical Signals:

Optical signals are limited to a little distance (less than 100 meters) and are absorbed into the water immediately, although they can transmit more information.

### D. Optical Fiber Cables:

It has a high propagation delay, unreliable and unpredictable channel behavior and low data transmission speed due to the fading of the complex multipath, predominant Doppler effects and significant temperature-dependent variation in these properties: salinity or pressure.

## III. Applications of UWSN [23]

The application of WSN to the underwater domain plays a big role. They can be used to monitor the health of rivers and marine environments, which are expensive and difficult for humans. For manual monitoring, divers are regulated in the hours and depths they can operate and require surface vessels that are expensive to use. Further manual operations depend on weather conditions.

A sensor network installed under the water could observe the many somatic parameters such as certain pollutants, turbidity, pressure, conductivity and temperature. So, famous applications of Under Water Sensor Networks (UWSN) as shown in figure 2 are followings.

### A. Environmental Monitoring:

UWSNs can inspect the pollution such as chemical, biological and nuclear.

### B. Disaster Preventions:

UWSNs can measure seismic activity along the sea floor from remote locations and predict an approaching tsunami. This monitoring allows coastal areas to be notified and warned in time to prevent any disaster.

### C. Assisted Navigation:

Sensors can be utilized to distinguish chances on the seabed, find perilous shakes in profound water and inundated wrecks (Destroyed parts of ship due to accident).

### D. Under Sea Explorations:

Under water sensor networks systems can be utilized for distinguishing submerged oil fields or supplies, choosing course to lay submerged ocean links anticipate regular unsettling influence in the sea and help looking for esteemed minerals.

### E. Mine Reconnaissance:

Optical sensors can be used to perform rapid environmental assessments while monitoring several underwater acoustic vehicles with acoustic elements and sensors.

### F. Ocean Sampling Networks:

The network of sensors and underwater vehicles can be used for synoptic, cooperative and adaptive sampling of the marine environment.


Fig. 2: Applications of UWSN

## IV. Elements impacting UWC [22]

### A. Ambient Noise:

The ambient noise in the ocean has four sources by which it can be found are: turbulence, delivery, waves, and warm clamor.

### B. Multipath Channel:

Underwater channel is a known as period variable multipath channel on the grounds that behind this reasons are ISI, ICI (Inter Channel Interference) and obscuring. Due to the effect of time and repeat spreading, succeeding high data rates in submerged remote correspondence is particularly trying.

### C. Doppler Effect:

The Doppler Effect is substantially less complex, as a result of the accompanying reasons: the speed of sound is low, the framework is inalienably a wide band framework, and for the most part Doppler Effect is caused by:

1) Doppler move caused by tx/rx movement.
2) Doppler move caused by the moving ocean surface

## V. Parameters to analyses UWSN communication [22, 29, 30, and 31]

### A. Energy Consumption:

It speaks to the aggregate vitality devoured in parcel conveyance, including transmitting, getting, and lingering vitality utilization of all hubs in the system.

### B. Packet Delivery Ratio:

This is characterized as the proportion of the quantity of unmistakable parcels got effectively at the sinks to the aggregate number of bundles created at the source hub. Despite the fact that a parcel may achieve the sinks numerous circumstances, these repetitive bundles are considered as just a single unmistakable parcel.

### C. Average End-to-End Delay:

This is the average time taken by a package to development from the source center point to any of the sinks.

### *D. Throughput:*

Throughput is a measure of what number of units of information a system can process in a given time. It is connected extensively to frameworks extending from different parts of PC and system frameworks to associations. Performance of throughput measure in KB/Second

### *E. Communication Paradigm:*

This is the method of propagation by which communication occur inside the water i.e Magnetic Induction [MI], Electromagnetic [EM], Acoustic, optical method.

### *F. Propagation Speed:*

The speed at which electrical signals can travel and limited as a percentage of the speed of light.

### *G. Data Rate:*

The amount of data per second sent or received.

### *H. Communication Ranges:*

Communications range is one-way or two-way short-range to medium-range wireless communication channels planned for motorized use protocols and standards.

### *I. Channel Dependency:*

This means, signal depends on the channel by which communication occurs.

### *J. Network Lifetime:*

It is the time length between the network induction and the whole energy of the considerable number nodes.

### *K. Average Energy Consumption:*

It is the energy consumption of all the active nodes of network in 1 round.

### *L. Probability of Dropped Packets:*

It demonstrates the likelihood of loss of packets in 1 round.

### *M. Number of Dead Nodes:*

It demonstrates the quantity of dead nodes of the network.

### *N. Confidence Interval:*

It is an interim in which an estimation or trial falls relating to a given probability.

### *O. Parameter δ (Holding Time):*

A node uses holding time to schedule packet forwarding. At every node, every packet's holding time is calculated by distinction between the depth of the packet's earlier hop and also the depth of current node. Nodes with completely different depths can have different holding times even for an equivalent packet.

### *P. Depth Threshold (DTH):*

The depth threshold means to the exchange off between packets conveyance proportion and energy utilization. With a bigger limit, fewer nodes will be associated with packets sending, and in this manner less energy is spent.

### *Q. Node Mobility:*

The node mobility effects on communication at the same time, the probability that a forwarding node has a smaller distance to the sinks increases as more nodes participate in packet forwarding.

### *R. Number of Sinks:*

We observe that the energy consumption is almost the same for different number of sinks.

## VI. PARAMETERS USEFULL IN SIMULATION [29]

1) Network size
2) Node number
3) Initial energy of normal nodes
4) Data aggregation factor
5) Packet size
6) Transmission Rang
7) Number of Courier nodes
8) Number of Simulations

## VII. CHALLENGES IN MOBILE UWSN DESIGN [19]

1) Security, Resilience, and Robustness
2) Reliable and/or Real-Time Data Transfer
3) Traffic Congestion Control
4) Efficient Multi-hop Acoustic Routing
5) Distributed Localization and Time Synchronization
6) Efficient Multiple Access
7) Acoustic Physical Layer

## VIII. CONCLUSIONS

In this paper, we have clarified different steering conventions portrayed in underwater remote sensor arranges hypothetically. Fundamental reason for different directing conventions is to confront challenges in UWSN. Different application areas for enhancing conveyance speed with least bundle misfortune. We have shown two one of kind circumstances: significant and shallow water. Directing conventions rely upon different correspondence medium as transfer speed is a noteworthy issue in underwater remote sensor systems. We have talked about near investigation on different correspondence mediums. It will be useful to the analysts for constraints in different application areas. Further, we have given itemized real parameters in underwater remote sensor systems contrasted and earthbound systems.

## IX. FUTURE SCOPE

Grouping systems enhance throughput and unwavering quality while limiting force utilization. Strength reaping can improve steering in underwater remote sensor systems. For long separation, strength gathering will give a safe and solid arrangement towards assortment of use, for example, catastrophe and contamination control. Streamlined way choice towards goal to categorize the various underwater protocols and their comparison.

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